CLAIMS

What is claimed is:

1. A high-barrier, moisture-insensitive coating containing at least 2% by weight solids in water, wherein the solids portion of the composition comprises:

   a. from 25 to 55% by weight, a nonpolymeric organic binder comprising at least one member selected from the group consisting of melamine, formaldehyde, derivatives of melamine, and derivatives of formaldehyde, where such derivatives are capable of chelation with boric acid;

   b. optionally, a water-soluble or water dispersible organic binder, selected from the group consisting of

      i) polysaccharides and cellulosic materials selected from cellulose, hydroxymethyl cellulose, carboxymethyl cellulose, amylose, pluran, starch, and hydroxyethyl cellulose;

      ii) water-soluble ethylene- vinyl alcohol (EVOH) copolymers;

      iii) water-soluble polyamides;

      iv) melamine formaldehyde resin;

      v) polyethylene glycol; and

      vi) blends thereof;

   c. from 10% up to 70% by weight, based on the dry weight of the first coating layer, an inorganic laminar mineral selected from the group consisting of montmorillonite, laponite, organo-modified montmorillonite and mixtures thereof;

   d. from 2 to 12% by weight , based on the dry weight of the first coating layer, boric acid; and

   e. from 0 to 6% by weight, based on the dry weight of the first coating layer, of a hydroxyl-containing species, other than poly(vinyl alcohol), that has two hydroxyl groups on one side of the molecule with which the boric acid can form a chelate.

2. The coating composition of Claim 1, wherein the nonpolymeric organic binder is made from melamine and formaldehyde.

3. The coating composition of Claim 1, wherein the ratio of boric acid to hydroxyl-containing species is 1:1.

4. The coating composition of Claim 1 wherein the hydroxyl containing species is d-mannitol.

5. The coating composition f Claim 1 wherein the nonpolymeric organic binder is made from melamine and formaldehyde, the ratio of boric acid to hydroxyl-containing species is 1:1, and the hydroxyl containing species is d-mannitol.

6. The coating composition of Claim 1 comprising

a. a montmorillonite clay;
b. a nonpolymeric organic binder made from melamine and formaldehyde;
c. boric acid; and
d. d-mannitol,

wherein the ratio of a:b:c:d is 5:4:0.5:0.5 by weight.

7. The coating composition of Claim 1, wherein the optional water-soluble or water dispersible organic binder is present and such binder is selected from the group consisting of

i) polysaccharides and cellulosic materials selected from cellulose, hydroxymethyl cellulose, carboxymethyl cellulose, amylose, pluran, starch, and hydroxyethyl cellulose;
ii) water-soluble ethylene- vinyl alcohol (EVOH) copolymers;
iii) water-soluble polyamides;
iv) melamine formaldehyde resin;
v) polyethylene glycol; and
vi) blends thereof.

8. A polymeric substrate coated with a coating comprising the coating composition of Claim 1.

9. The polymeric substrate of Claim 8 in the form of a film, sheet, or tubing.

10. A polymeric container which comprises:

a. a polymeric substrate shaped to define a container;
b. a first coating layer adhered to at least one surface of the polymeric substrate and capable of retarding the transmission of oxygen, water vapor, and carbon dioxide

through the substrate, said first coating layer comprising the composition of Claim 1; and

c. an optional clear coat layer adhered to the first coating layer, said clear coat layer comprising a curable composition comprising a binder component in an organic solvent.

11. The polymeric container of Claim 10 which is rigid.

12. The polymeric container of Claim 10 which is a bottle.

13. The polymeric container of Claim 12 which is a biaxially oriented poly(ethylene terephthalate) bottle.

14. The polymeric container of Claim 11 which is a can.

15. The can of Claim 14 which is a plastic aerosol can.

16. The can of Claim 14 which is a plastic coffee can.

17. A method for decreasing the permeability of a polymeric substrate, comprising the steps of:

a. forming the polymeric substrate;

b. optionally, heating the polymeric substrate surface before applying a first coating layer;

c. optionally, preheating an aqueous composition that will be used to form said first coating layer;

d. applying to at least one surface of the polymeric substrate said first coating layer having a thickness in the range of 8 microns or less by spraying or dip coating onto the polymeric substrate, said aqueous composition comprising the coating composition of Claim 1;

e. drying the first coating layer at ambient or slightly elevated temperature;

f. curing it at a temperature below the temperature at which heat distortion of the polymeric substrate can occur; and

g. optionally, applying to the first coating layer a second, clear coat layer having a thickness in the range of about 12 microns or less by spraying onto said first coating layer a curable composition comprising (a) a binder component and (b) an organic solvent; and curing said second coating layer.

18. The method of Claim 17 wherein the aqueous composition of step (c) is preheated at 75 to 90°C for 5 to 15 minutes.

19. The method of Claim 17 wherein curing step (f) is carried out by exposing the coating layer to UV/NIR radiation.

20. The method of Claim 19 wherein curing step (f) is carried out after the clear coat layer is applied in step (g).

21. The method of Claim 17 wherein the polymeric substrate is in the form of a film, sheet, bottle, container, or tubing.

22. A laminate comprising at least two layers, at least one of which comprises the coating composition of Claim 1.

23. The laminate of Claim 22 which comprises at least three layers, wherein at least one inner layer comprises the coating composition of Claim 1 and at least one outer layer comprises at heat sealable polymer film.

24. The laminate of Claim 23 comprising the sequential layers:

a. poly(vinylidene chloride);
b. poly(ethylene terephthalate);
c. the coating composition of Claim 1;
d. poly(ethylene terephthalate);
e. poly(vinylidene chloride).

25. The laminate of Claim 23 comprising the sequential layers:

a. poly(vinylidene chloride);
b. poly(ethylene terephthalate);
c. the coating composition of Claim 6;
d. poly(ethylene terephthalate);
e. poly(vinylidene chloride).

26. A display device comprising the laminate of Claim 22.

27. A time or temperature-time indicating device comprising an indicating material sealed inside a polymeric package comprising the laminate of Claim 23, wherein the color of the indicator changes the presence of a substance that continuously permeates into the package.

28. The indicating device of Claim 27 wherein the substance that continuously permeates into the package is oxygen or water vapor.